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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Emergence and Survival of Winterfat Seedlings from Four Planting Depths

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Winterfat (Eurotia lanata) fruits and seeds from three sites in New Mexico were planted at 0, 1/8-, 1/4-, and 1/2-inch depths in soils from those sites. Seedling emergence and survival were highest from surface planting, and decreased with planting depth to none at 1/2-inch depth. Threshed seeds showed advantages over fruits, especially for surface planting. The results suggest seeds should be planted on or near the surface when soil moisture is between field capacity and saturation. (KEY WORDS: Eurotia lanata, winterfat, range management, forage plants, plant physiology)

Winterfat (Eurotia lanata (Pursh) Moq.) has good potential for revegetation because of its drought resistance, palatability, and nutritive value. Attempts to establish this species by direct seeding in New Mexico, however, have given erratic results.

Many factors probably affect the germination and establishment of winterfat, but past research indicates depth of seeding is an important consideration. Wilson (1931) reported much of the seed on the soil surface will germinate if there are several days of wet weather during fall and winter, and recommended covering the seed no more than 1/4 inch deep. Hilton (1941) reported no seedling emergence from seeds planted 1/2 inch or deeper under high soil temperatures. Riedl et al. (1964) obtained good stands from planting seed 1 to 2 inches deep in old furrows on sod in Wyoming. Other trials in Wyoming, however, showed better emergence from 1/4 inch than from 1/2- or 3/4-inch-deep plantings (Statler 1967).

This study was undertaken to determine, for important soil types and seed sources in New Mexico, the effect of planting depths on seedling emergence and survival of winterfat.

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Methods

Three sources of seed were planted at four depths in three different soils in July 1968 (table 1). The soils were obtained from the same sites as the seeds. Whole fruits and threshed seeds were compared. Tests were made in plastic trays, which were completely randomized in a 3 x 3 x 2 factorial design. Each combination of soil, seed source, and fruit or seed was planted in a single tray (fig. 1). Depth of planting was introduced as a split-plot feature with fruits or seeds planted at all four depths in each tray. Fruits and seeds were planted at the rate of 20 viable seeds per 6-inch row. The number of fruits planted varied by source according to the percentage that contained seeds.

Depths of seeding were surface, 1/8 inch, 1/4 inch, and 1/2 inch. The experiment was conducted outdoors on a north exposure where there was protection from rain and direct sunlight, but no control of temperature or wind. A very light layer of soil was spread over seeds and fruits planted on the surface to prevent the wind from blowing them out of the rows.

Table 1.--Data on three soils and sources of winterfat seed, collected in New Mexico, October 1967

Name and location of collection site	Elevation	Annual precipitation	Soils data					Seed data			
			Texture	pH	Moisture			Fruits	Seeds	Filled fruits	Fruits per row
					Saturation	1/3 bar	15 bar				
	Feet	Inches			- - Percent - -			Number per pound		Percent	Number
Wingate (W): 18 miles east of Gallup	7,400	12	Clay	7.8	46.8	18.9	11.9	70,700	212,600	80	25
Quail Restoration Area (QRA): 8 miles west of Santa Fe	6,400	12	Sandy loam	7.1	30.6	11.8	5.3	78,700	208,200	91	22
Silver Hill (SH): 8 miles west of Magdalena	6,900	11	Loamy sand	7.6	27.4	6.4	3.6	68,800	209,700	88	23

Moisture was maintained between saturation and field capacity during the first month of the experiment. Whenever the surface of the soil showed signs of drying the trays were subirrigated until the surface became moist, then excess water was allowed to drain through holes in the bottom of the trays. The trays were carefully rewatered as necessary during the first 2 weeks, when seedlings were emerging. Moisture was not as carefully controlled during the second 2 weeks, but it is unlikely the soils dried much below field capacity for more than a day or two.

The experiment was begun July 3, 1968. Emerging seedlings were counted until August 3, 1968, after which no new seedlings emerged. Seedlings were considered emerged when the cotyledons were 1/2 inch above the soil surface. Seedling emergence percentages were transformed to arc sin for analysis of variance.

Air and soil temperatures were determined by thermistors (Swanson 1967). Thermistors were placed at each depth of planting in each soil. No differences were found between soils or depths. During the first week when most seedlings emerged, daily air temperatures ranged from 58° to 82° F; corresponding soil temperatures varied from 54° to 71° F.

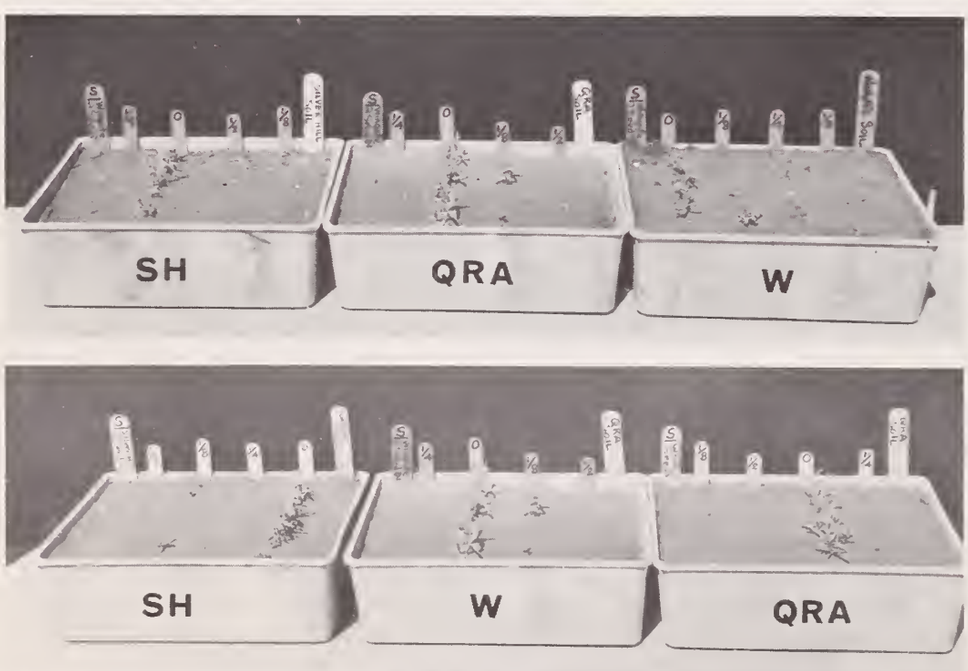


Figure 1.--Seedling establishment 30 days after seeding:

Wingate seeds in three soils.

Three seed sources in QRA soil.

Results and Discussion

Seedling emergence from planted seeds or fruits was highest on the surface of the soil, and decreased with planting depth to none at 1/2 inch (table 2). The three sources of seed gave essentially the same results.

For all sources of seeds and soils twice as many seedlings emerged from seeds as from fruits. The advantages of seeds over fruits was greatest for surface planting (fig. 2). When planted 1/8 inch deep, fruits and seeds produced about the same number of seedlings.

Seedling emergence for seeds planted on the surface reached a maximum 8 days after planting (fig. 2). Seedlings began emerging the third day after seeds were planted. Emergence was slower for surface-planted fruits, and for fruits and seeds planted 1/8 inch deep.

Some seedlings died regardless of the source of seed or soil. Seedling losses were somewhat greater in the Silver Hill loamy sand soil, however, presumably due to the poor moisture-holding capacity of this soil. Mortality was especially noticeable from the 12th to 14th day, when there were strong dry winds that probably imposed exceptional stresses on the young seedlings. Appearance of the dead and dying seedlings indicated mortality was caused by these stresses rather than by disease organisms, although some seedlings may have succumbed to damping-off fungi. Seedling survival 30 days after planting showed the same relationships as emergence: more seedlings survived from seeds planted on the surface.

Table 2.--Number of winterfat seedlings per 100 seeds that emerged[1] or survived[2] from fruits or seeds planted at three depths--surface, 1/8 inch, and 1/4 inch

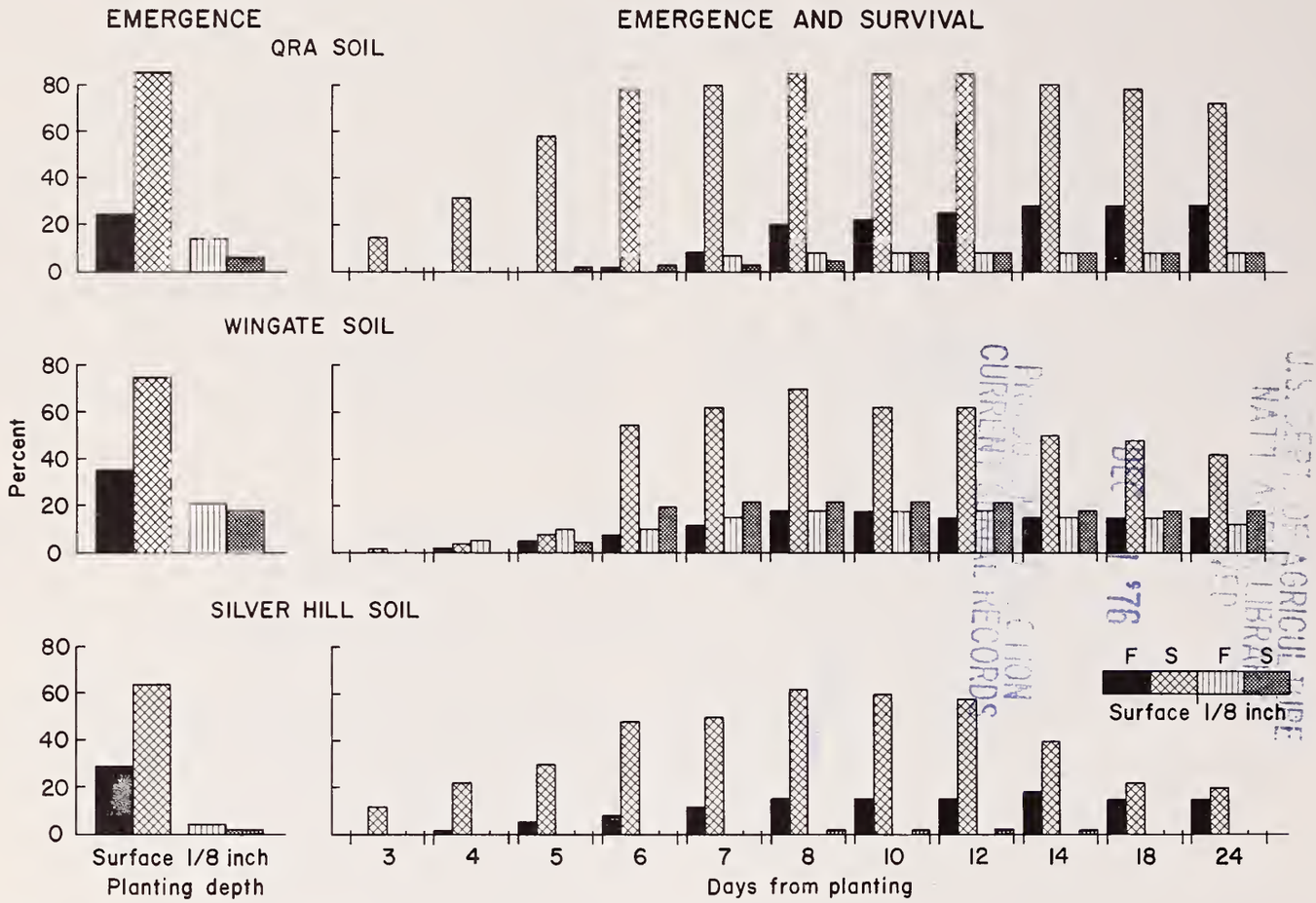
Source of seed	Source of soil	Fruit or seed planted	Seedlings per 100 seeds by planting depth					
			Surface		1/8 inch		1/4 inch	
			Emerged	Survived	Emerged	Survived	Emerged	Survived
			- - - - - - - - - Number - - - - - - - - -					
QRA	QRA	F	28	28	8	8	0	0
		S	85	68	8	8	0	0
	Wingate	F	42	15	20	12	0	0
		S	80	35	8	5	0	0
	Silver Hill	F	20	8	2	2	2	2
		S	72	22	0	0	0	0
WINGATE	QRA	F	18	12	15	15	0	0
		S	90	65	10	10	0	0
	Wingate	F	18	12	18	10	0	0
		S	70	42	22	18	8	2
	Silver Hill	F	50	42	10	8	0	0
		S	58	40	5	0	0	0
SILVER HILL	QRA	F	28	15	20	15	0	0
		S	80	55	2	2	0	0
	Wingate	F	48	30	28	20	2	0
		S	75	48	25	15	2	0
	Silver Hill	F	18	15	0	0	0	0
		S	62	20	2	0	0	0

[1]Maximum number.
[2]Number alive 30 days after seeding.

Figure 2.--Percentages of winterfat seedlings that emerged and survived from fruits (F) and seeds (S) planted on the surface and 1/8 inch deep:

Averages for three seed sources in each soil.

QRA seeds in QRA soil;
Wingate seeds in Wingate soil;
Silver Hill seeds in Silver Hill soil.



Conclusions

The results of this experiment suggest that shallow seeding of winterfat is essential. Relatively poor stands resulting from the 1/8-inch depth compared with surface planting indicate the optimum depth may be about 1/16 inch, although this depth was not tested. Threshed seeds appear to have advantages over whole fruits, not only because of the better stands produced, but also because seeds are less subject to wind movement and are more easily covered with a thin layer of soil. The fluffy nature of whole fruits also makes them difficult to handle and sow, especially with mechanized equipment.

Additional research with threshed seeds is needed to determine how soil moisture affects seedling emergence and survival from surface and shallow planting.

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